ABSTRACT OF THE DISCLOSURE

An image which is determined by surface is captured and stored by sensing device. Subsequently, at a second image corresponding to a displacement of the surface is captured and stored. The two images are repeatedly compared at different offsets in a displacement direction. Theoretically, the most extreme value of the comparison will occur at the image offset that corresponds exactly with the actual displacement. However, typically none of the comparison offsets correspond exactly with the actual displacement, therefore interpolation between the comparison offsets is required. The method of comparing the images, as well as the method of interpolating to determining the image offset corresponding to the extreme value of the comparison can both contribute to systematic errors in estimating the displacement of the surface from the images. Herein, the systematic errors are rejected by correlation-based comparison systems and methods which reduce the curvature of the correlation function for offsets which bound the extreme value, and by interpolation systems and methods which are relatively insensitive to the asymmetry of the correlation function value points selected as the basis for the interpolation. These systems and methods allow fast, highly accurate, displacement determinations using relatively simplified calculations and relatively few correlation function value points. Thus, such a displacement measuring system can track high speed displacements with high accuracy. The systems and methods are especially suitable for measuring displacement of a surface using speckle images.